No. 678,261. Patented July 9, 1901.

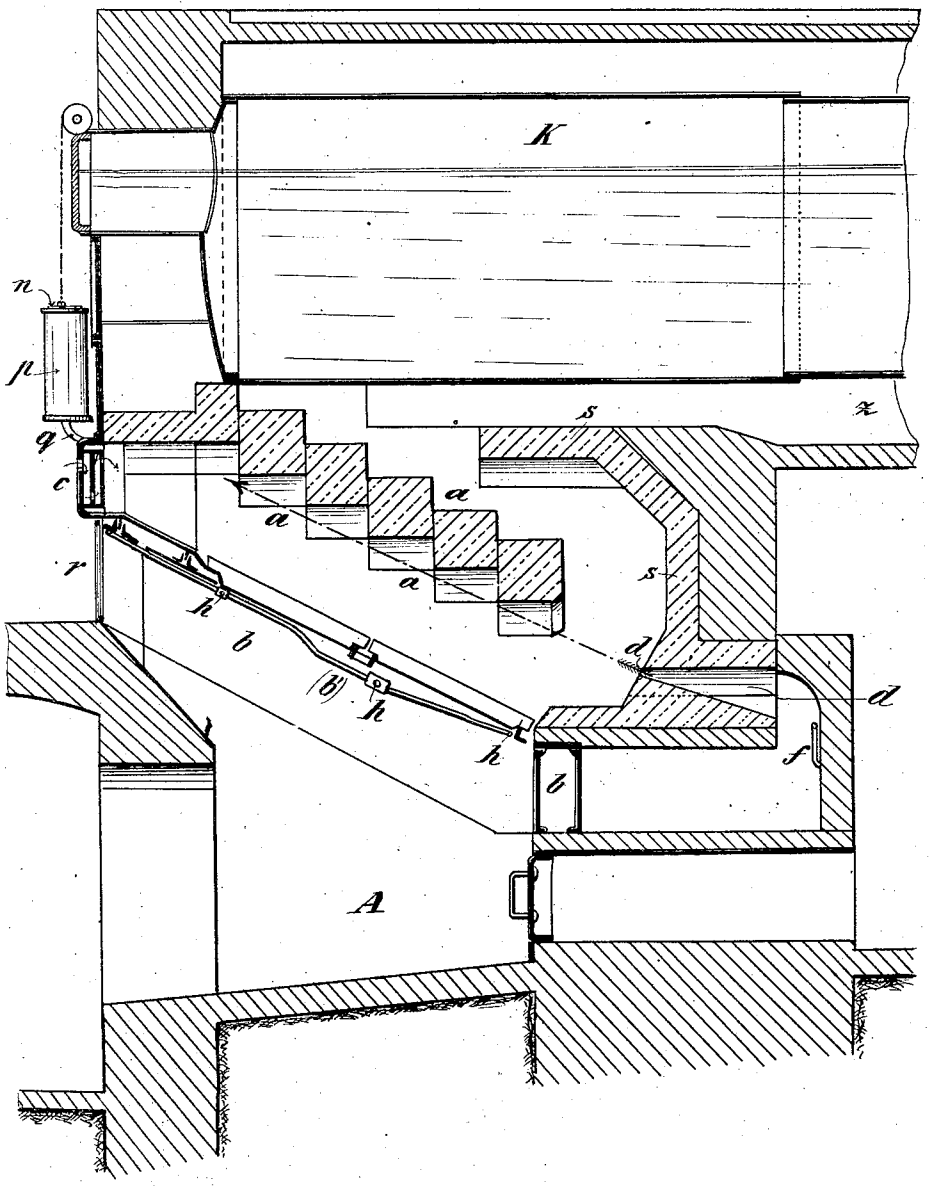
A. KRIPPEL.

SMOKE CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

(Application filed Dec. 24, 1897.)

(No Model.) 8 Sheets—Sheet 1.

Fig. 1.



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No. 678,261. Patented July 9, 1901.

A. KRIPPEL.

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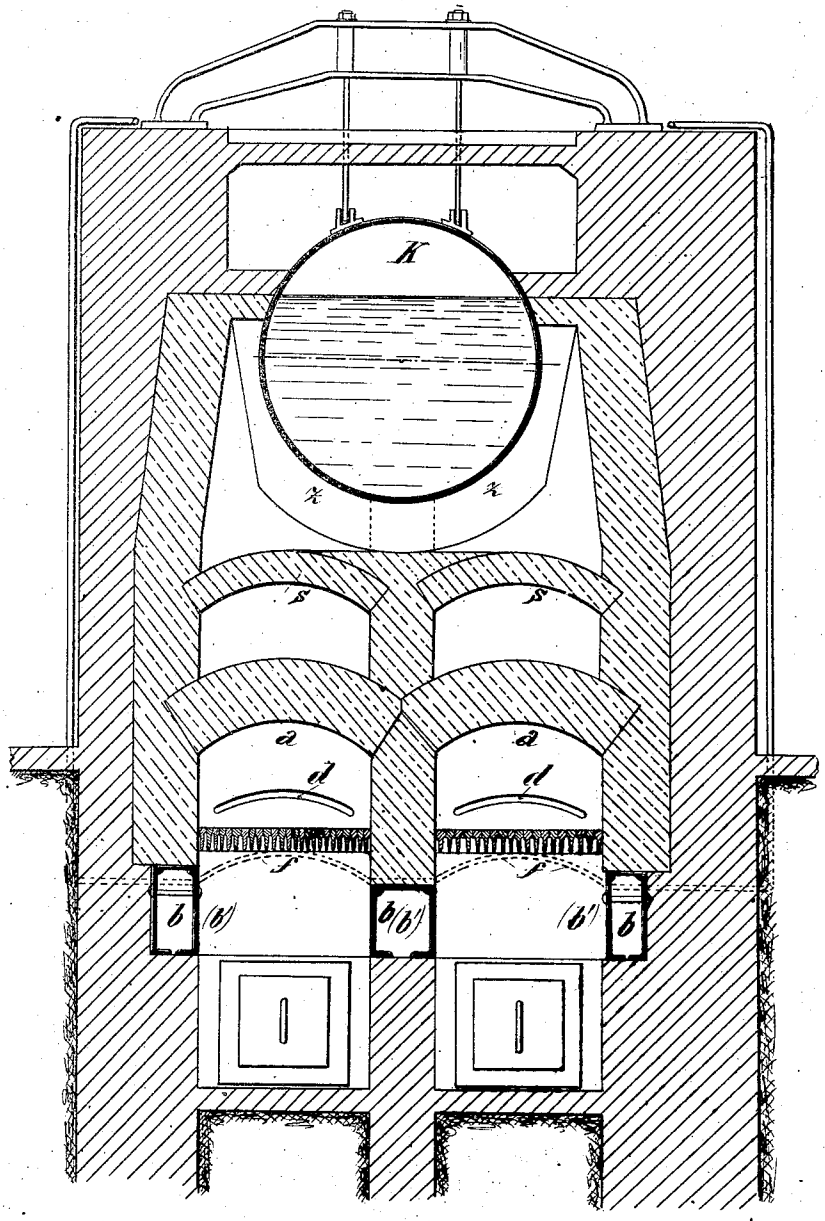
(No Model.) 8 Sheets—Sheet 2.

Fig 2



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No. 678,261. Patented July 9, 1901.

A. KRIPPEL.

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(No Model.) 8 Sheets—Sheet 3.

Fig. 3.

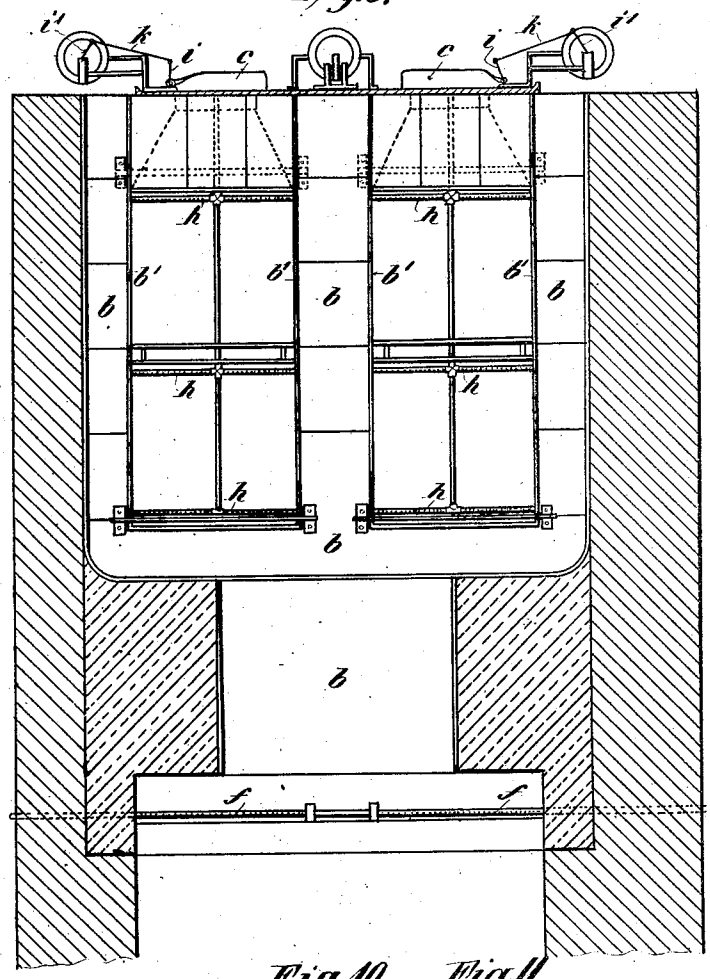

Fig. 10.

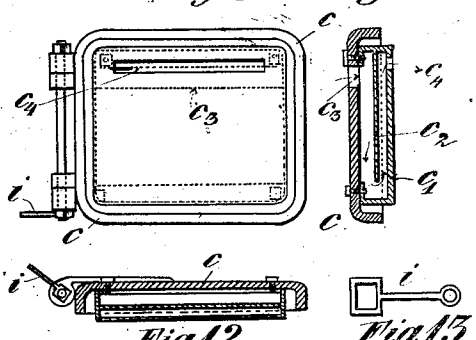

Fig. 11.

Fig. 12.

Fig. 13.

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No. 678,261. Patented July 9, 1901.

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SMOKE CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

(Application filed Dec. 24, 1897.)

(No Model.) 3 Sheets—Sheet 4.

Fig. 4.

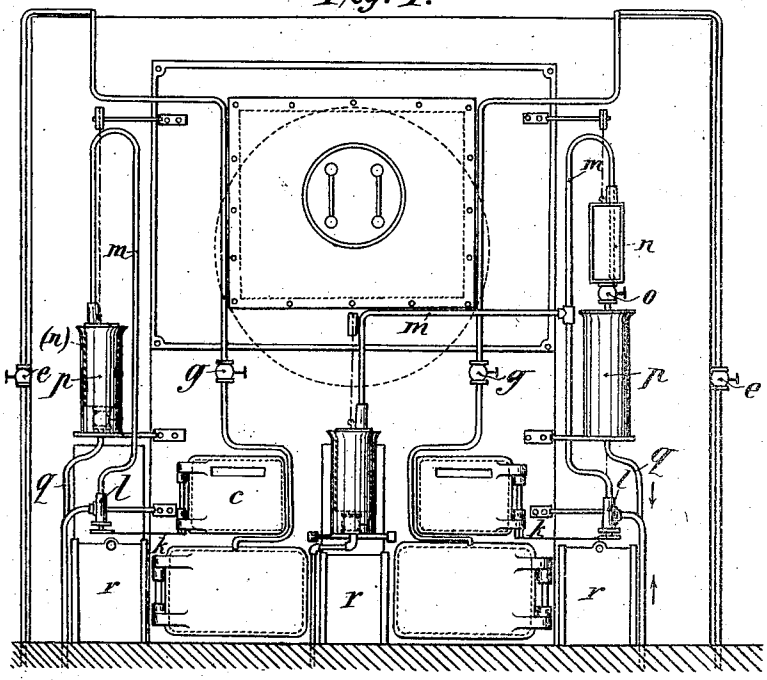


Fig. 5.

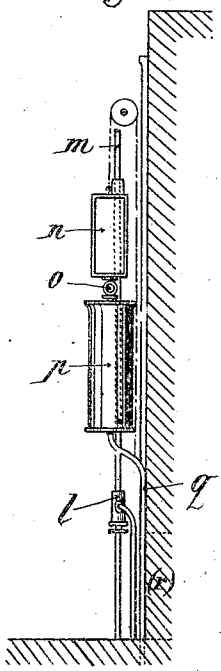


Fig. 17.

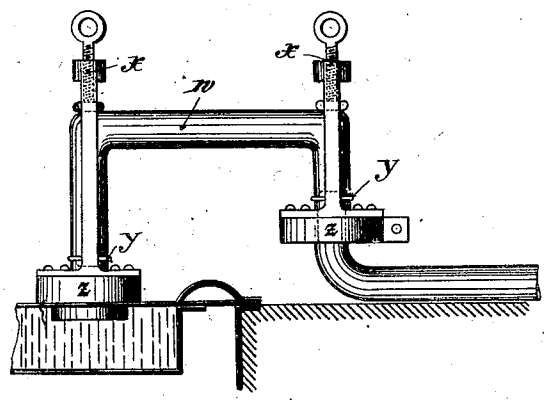
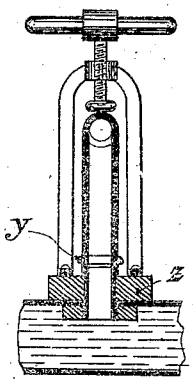


Fig. 16.



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A. KRIPPEL.

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(Application filed Dec. 24, 1897.)

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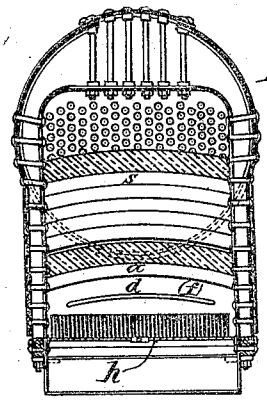


Fig. 9.

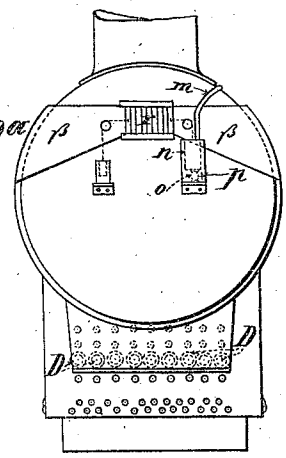


Fig. 9a.

Fig. 6.

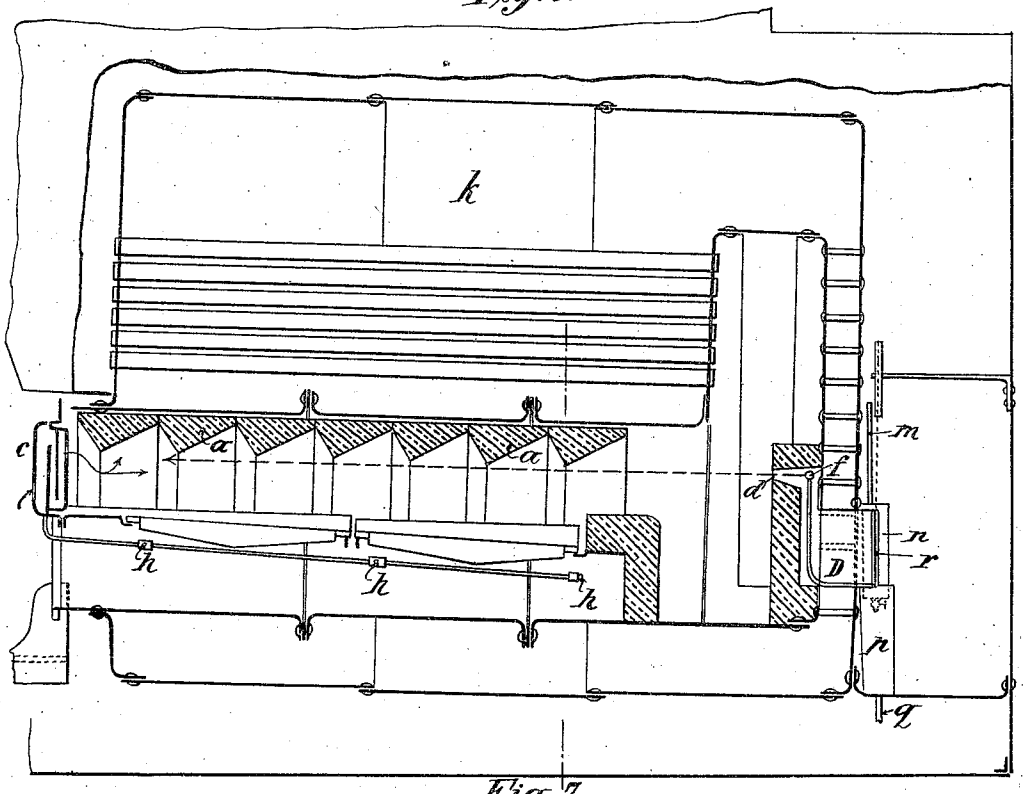
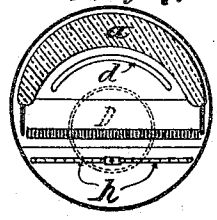


Fig. 7.



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No. 678,261. Patented July 9, 1901.

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SMOKE CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

(Application filed Dec. 24, 1897.)

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Fig. 6a

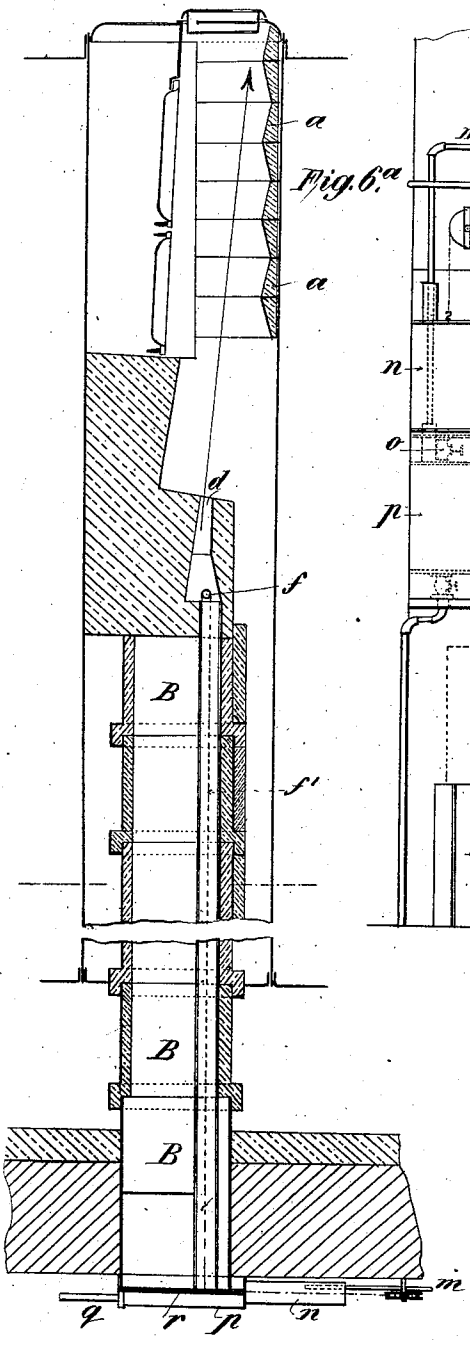


Fig. 15

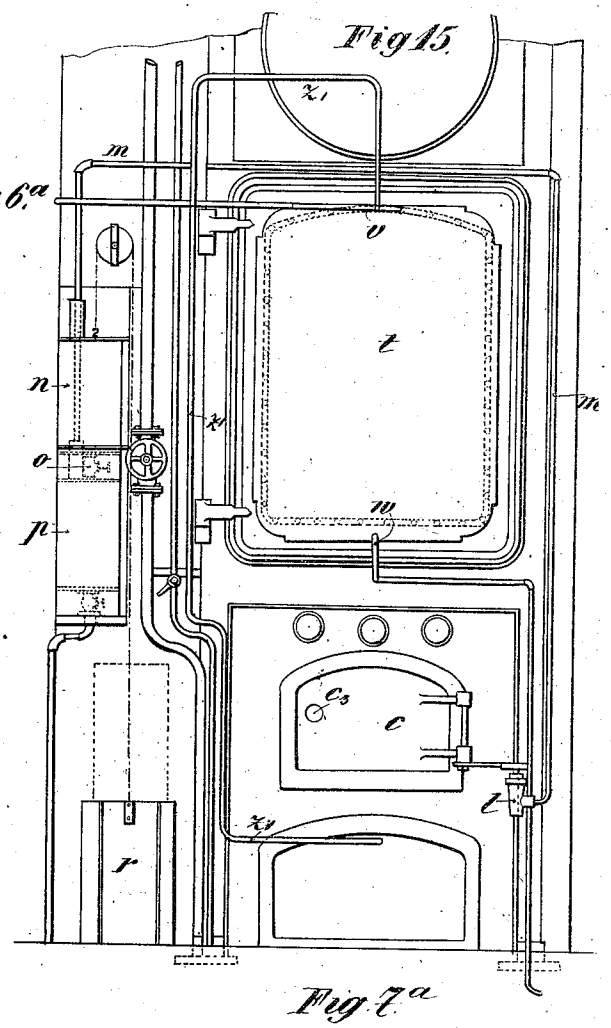
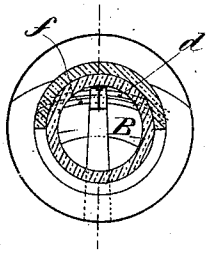


Fig. 7a



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No. 678,261. Patented July 9, 1901.

A. KRIPPEL.

SMOKE CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

(Application filed Dec. 24, 1897.)

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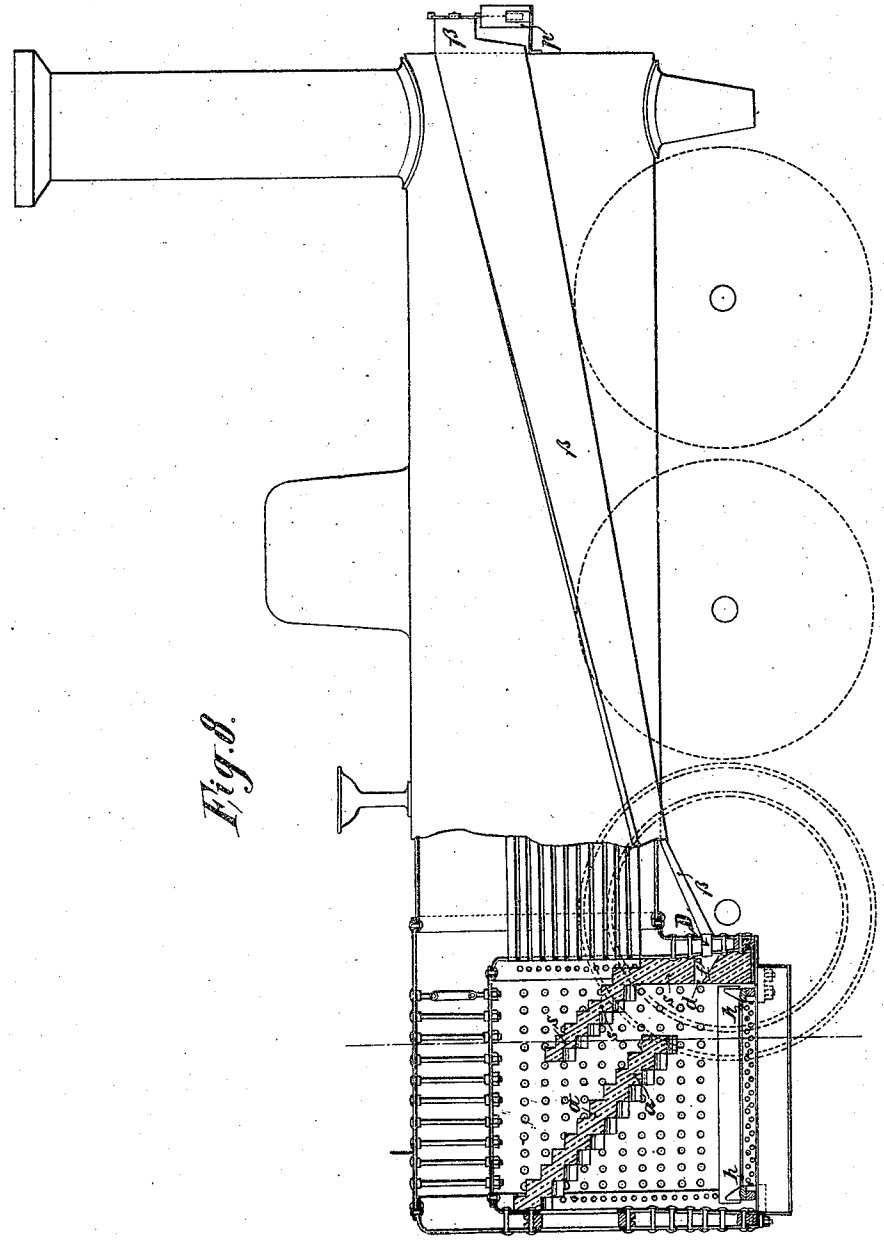

Fig. 8.

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No. 678,261. Patented July 9, 1901.

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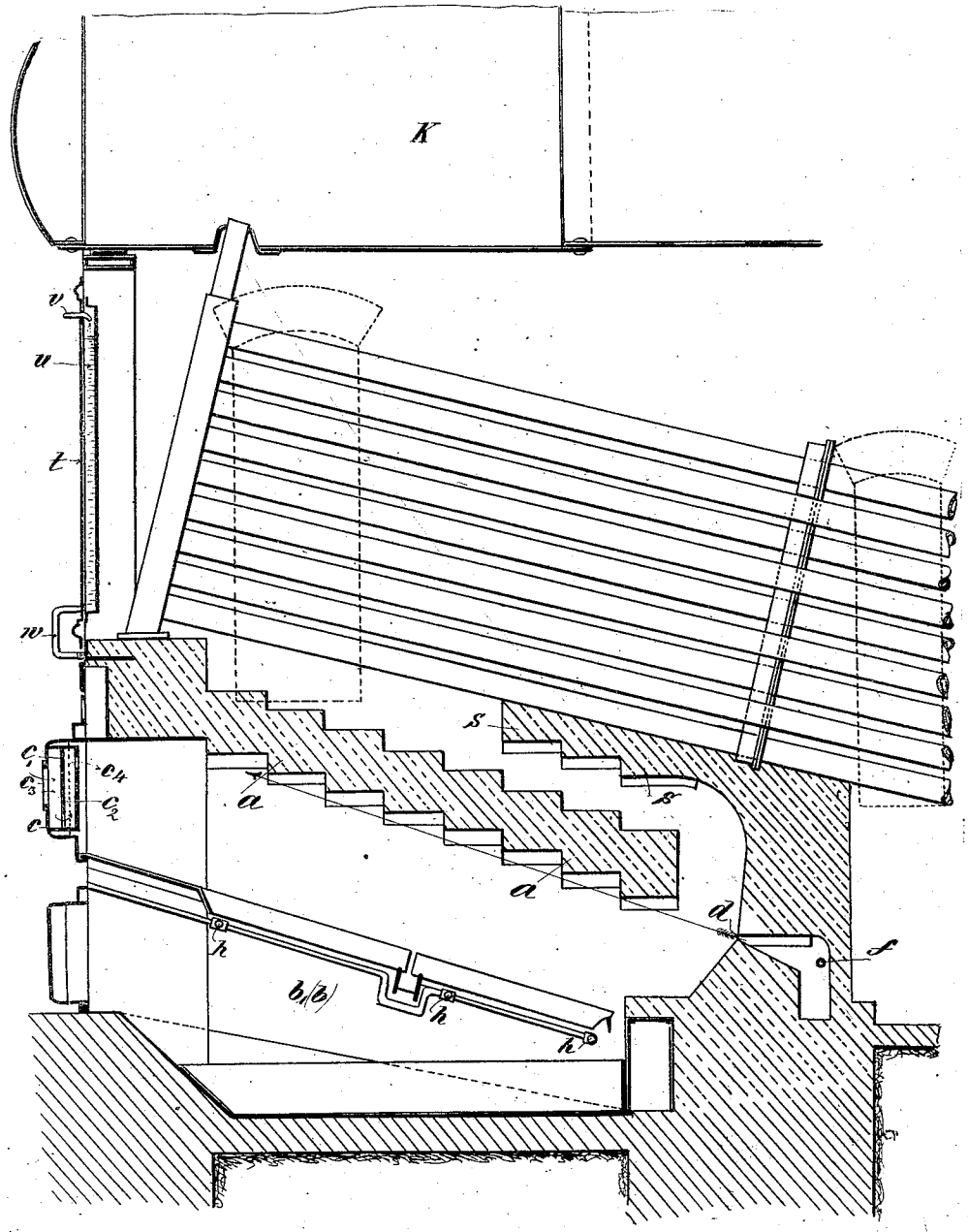
SMOKE CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

(Application filed Dec. 24, 1897.)

(No Model.) 8 Sheets—Sheet 8.

Fig 14



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UNITED STATES PATENT OFFICE.

AUGUST KRIPPEL, OF VIENNA, AUSTRIA-HUNGARY.

SMOKE-CONSUMING FURNACE AND APPARATUS IN CONNECTION THEREWITH.

SPECIFICATION forming part of Letters Patent No. 678,261, dated July 9, 1901.

Application filed December 24, 1897. Serial No. 663,356. (No model.)

To all whom it may concern:

Be it known that I, AUGUST KRIPPEL, a subject of the Emperor of Austria, residing in the city of Vienna, in the Province of Lower Austria, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Smoke-Consuming Furnaces and Apparatus in Connection Therewith, (for which I have obtained patents in Germany, No. 91,332, dated February 15, 1896; in France, No. 259,035, dated August 20, 1896; in Austria, No. 46/3,083, dated August 3, 1896, and in Belgium, No. 127,365, dated April 3, 1897,) of which the following is a specification.

This invention relates to a smoke-consuming furnace and apparatus in connection therewith; and the object of the invention is to unite in such a furnace a rational supply of air with a very high temperature, so as to permit of a great working capacity within considerable range.

The invention consists of certain features of construction and combinations of parts, to be hereinafter described and then particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section. Fig. 2 is a cross-section. Fig. 3 is a horizontal section. Fig. 4 is a front elevation, and Fig. 5 is a side view, of an ordinary cylinder-boiler provided with my improved smoke-consuming device. Fig. 6 is a vertical longitudinal section. Fig. 7 is a cross-section through a ship-boiler with such a firing. Fig. 6^a is a vertical longitudinal section, and Fig. 7^a is a cross-section, of a flame-flue with my improved smoke-consuming device. Fig. 8 is a vertical longitudinal section of a locomotive, partly in section, through the fire-box. Fig. 9 is a cross-section of the same. Fig. 9^a is a front elevation of the same. Fig. 10 is a front view of the fire-door. Fig. 11 is a transverse section of the same. Fig. 12 is a horizontal section thereof, and Fig. 13 is a detail view of a part thereof. Fig. 14 is a vertical longitudinal section; and Fig. 15 is a front elevation of a water-tube boiler of the Babcock and Wilcox type, and Figs. 16 and 17 are respectively a detail cross-section and a side elevation of the pipe connection leading to the water-chamber of the door at the ends of the flues.

Similar letters of reference indicate corresponding parts.

To prevent the transmission of heat by radiation during the formation of the heating-gases to the surrounding water-moistened walls of the furnace, which would cause a lowering of the temperature therein, the rearwardly and downwardly sloping arches *a* over the fire-chamber are made of fire-brick or other suitable non-conducting material, such as fire-clay, silicate of magnesia, Dynas brick, and the like.

Below the grate and at the sides of the ash-pit A are arranged air-channels *b*, Figs. 1, 2, 3, and 14, which are separated from the ash-pit by means of iron side plates *b'*. The air-channels *b* are arranged under the walls of the fire-chamber and to one side of the space occupied by the fire-chamber, so as to have an ash-pit undiminished in size. The object of said air-channels is to utilize the high temperature of the air under the grate for preliminarily heating the secondary air which passes through said channels and to improve the durability of the grate by the simultaneous cooling of the ash-pit. The said iron plates *b'* very quickly take up the heat radiating downward from the grate and impart the same to the air circulating in the side air-channels *b*, which are closed at their outer ends by means of slide-valves or dampers *r*. When the slide-valves *r* are opened, the heavier external air rushes into the air-channels *b* and presses the warmer and thinner air through a narrow transverse slot *d*, arranged at the rear end of the fire-chamber of the furnace, through which the air is discharged with great force into the fire-chamber. This slot *d* tapers or gradually decreases in area toward the fire-chamber and is arranged in such a manner above the grate that the relatively cool air enters at a point as high as possible above the fuel, but directly below the arches *a*, and then flows inwardly in the direction of and to the fire-door *c* into the fire-chamber, where it suddenly expands and is thoroughly mixed with the combustion-gases coming from the direction of the fire-door. In this way the exhausting or air-suction action of the chimney is placed in front of the furnace, and thereby a high muzzle velocity through the

slot *d*—that is to say, a high discharge velocity—into the fire-chamber of the cold air taken from the outside is obtained. The objectionable heat radiating against the fire-door is also used in the same way, as it also preliminarily heats the air entering *b* through the outside, and it is conducted to and fro before it enters the furnace at a point c^4, Fig. 14, as high as possible above the grate.

By reason of the high temperature in the fire-chamber this cooling of the fire-door by the entering of fresh air is indispensable. The mixing of the gases with the primary air passing up through the grate and with the secondary air entering through the fire-door *c* is effected by the stepped or offset arrangement of the arches *a* above the fire-chamber, inasmuch as the gases strike against the edges of the said arches, so that a whirling motion is imparted to them. The number of the channels *b* depends upon the size of the boiler and from local conditions. When bad coal is used or when clinker is on the grate or when the combustion is forced, an augmented supply of secondary air through the slot *d* can be effected by opening the valve *e*, Fig. 4, and admitting the steam through the perforated pipe *f*, which is arranged behind the slot *d*, so that the steam acts as an injector and takes the atmospheric air with it into the fire-chamber. Also steam may be admitted through the perforated pipe *h* below the grate by opening the valves *g*, Fig. 4. This steam passes through the clinkers, loosens the same, and thereby considerably reduces the production of the same, such steam being expanded by the high temperature encountered, so as to give way to the primary air entering the ash-pit from below. The continued supply of the secondary air would be excessive, and therefore result in a wasteful combustion of the fuel, and hence the secondary air is supplied intermittently at short intervals without the assistance of the fireman. As soon as the fire-door *c*, Figs. 1, 3, 4, 6, and 10 to 12, is opened the yoke *i*, Figs. 3, 10, 12, and 13, which is mounted rigidly on the pintle on which said door turns, turns with it, and through the medium of the links *k* and *i'* the plug-valve *l*, Fig. 4, is opened, whereby the hollow sheet-metal reservoir *n* is filled from the water-pipe *m*, in which said plug-valve turns. After the cylinder *n* is filled it is heavier than the slide-valve *r*, with which it is connected by means of suitable chains or ropes, so that the said valve *r* is lifted and the outside air can enter through the corresponding air-channel *b*. At the same time by means of the valve *o*, arranged below the cylinder *n*, a regular discharge of the water from the latter into the cylinder *p*, which is arranged below it, takes place, whereby the said cylinder *n* is after a certain length of time emptied and is lightened, so that the valve *r* lowers by reason of its own weight and overcomes the weight of and raises the cylinder *n*. From the cylinder *p* the water discharges through a discharge-pipe *q*. By adjusting the valve *o* the discharge of the water from the cylinder *n* into the receptacle *p* and the time for maintaining the valve *r* open may be regulated, so that the admission and the shutting off of the secondary air is automatically produced.

For the purpose of protecting the walls of the boiler from the direct flame of the fire a rear vault or arch *s*, of a suitable fireproof material, is provided. (See Figs. 1, 2, 8, 9, and 14.)

Referring to Figs. 10 to 13, it will be seen that the fire-door *c* is divided by a partition *c'* into two chambers. The air entering at c^3 into the first chamber is guided around the partition *c'* and enters the second chamber, and then passes through the slot c^4 into the fire-chamber at such a height above the fuel that the direct influence of the fresh air on the fuel is prevented. The fire-door is effectively cooled in this way by means of the air flowing in through the same.

In Fig. 14 the cleaning-door *t* in front of the tubes or flues has affixed thereto a suitable water-chamber *u*, to which water is supplied through a pipe *v*. The said chamber discharges through a pipe *w* into the receptacle serving to feed the water to the boiler. The pipes *v* and *w* are so arranged that they may be easily removed when this is necessary for opening the cleaning-door *t* to clean the boiler. To facilitate the detachment of the said pipes from the door *t*, the coupling-pieces of the said conduits are constructed in the form of yokes, Figs. 16 and 17, which are pressed air-tight to the mouthpieces *z* on the door *t* by means of screws *x*, mounted on suitable yokes, and suitable washers *y*. As owing to the high temperature the production of steam in the water-chamber *u* is possible, the same, as shown in Fig. 15, is arched on the top, and from the highest point of this arch a steam-discharge pipe *z'* leads to the ash-pit. By means of this construction not only is it possible to utilize the cleaning-door *t* as ordinarily, but a feed-water heater is also formed.

In Cornish, Tischbein, and other boilers of similar construction the secondary air is conducted through the flue from the rear by means of suitable pipes B, of some fireproof material, such as fire-clay, silicate of magnesia, &c. (See Figs. 6^a and 7^a.) These pipes B are made of such a size that between them and the walls of the flues the fire-gases may just pass, and the latter are pressed against these walls, so that the heating effect is considerably augmented. In furnaces for locomotive and marine boilers, Figs. 6, 8, and 9^a, the secondary air is conducted by tubes D, either one tube, Fig. 6, or several tubes, Figs. 8 and 9^a, which are fixed in the rear wall of the fire-box and serve instead of stiffening-bolts. These tubes D are by means of pieces *f*, which are set in, transformed into tapering slots. In a locomotive-furnace the mouth of the air-channel *b* is located at the front above

the door of the smoke-chamber, so that the velocity of the engine is used to produce compressed air. The air-channel becomes broader and flatter on the body of the locomotive and fits perfectly thereto, whereby the high temperature of the same is utilized for heating the compressed secondary air. In all these latter cases the self-acting hydraulic apparatus for opening and closing the secondary air-channels is used.

Having thus described my invention, what I claim is—

1. In a smoke-consuming furnace, the combination with the fire-chamber having a sloping arch, of air-conduits arranged below the fire-chamber and leading to the rear thereof, and a single tapering slot, located only in the fire-bridge approximately in line with said arch, said slot communicating with the air-conduits for discharging secondary air into the fire-chamber, substantially as set forth.

2. In a smoke-consuming furnace, the combination of the fire-chamber having a sloping arch and, at the rear, a tapering broad and narrow slot, arranged approximately in line with the under side of the arch, and means for conducting a supply of air through said slot to the fire-chamber, along and in intimate contact with the under side of the arch, substantially as set forth.

3. In a smoke-consuming furnace, the combination of the fire-door having an arm extending therefrom, a water-pipe provided with a cock, suitable means for connecting the latter with said arm or yoke, a conduit for supplying air to the fire-chamber, a valve or damper controlling the passage through the conduit, an operating-cord or flexible connection, a pulley over which the same runs, and a movable receptable suspended by said cord, over said pulley, and whereby it is connected with said valve or damper, and into which receptacle the said water-pipe discharges for lowering it, substantially as set forth.

In testimony whereof I have signed this specification in presence of two subscribing witnesses.

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